Alfvénic waves in the inhomogeneous solar corona

Richard J. Morton[1]
[1]Department of Mathematics, Physics and Electrical Engineering, Northumbria University, UK
e-mail: richard.morton@northumbria.ac.uk

The Sun's atmosphere is a highly structured plasma, with vertical gradients arising from gravitation and horizontal inhomogeneities resulting from heating and mass exchange along magnetic field lines. The result of this anisotropy is a plasma that supports a plethora of magnetohydrodynamic (MHD) wave modes, with a rich variety of dynamics. Recent observations of the Sun's atmosphere have shown the prevalence of MHD wave modes that have an Alfvén-like characteristic [1], and they are thought to be a key mechanism for energy transfer from the Sun's surface out into the heliosphere. The Alfvénic modes are hypothesised to power the million-degree corona of the Sun and other solar-like stars and accelerate solar/stellar winds to colossal speeds. However, their journey from the surface to the corona may not be as we had previously thought [2,3,4]. I will discuss how the highly-structured solar plasma leads to a distinct energy pathway for wave energy, focusing on interesting couplings of MHD waves modes. I will also show results from recent observations of the Sun's corona that provide the insights into the behaviour of these Alfvénic modes.

References
[1] S. Tomcyzk et al., Science **317** 1192 (2007)
[2] P. Cally, MNRAS **446** 413 (2017)
[3] R. J. Morton et al., Nature Comms. **6** 7813 (2015)
[4] R. J. Morton et al., Nature Astronomy **3** 223 (2019)

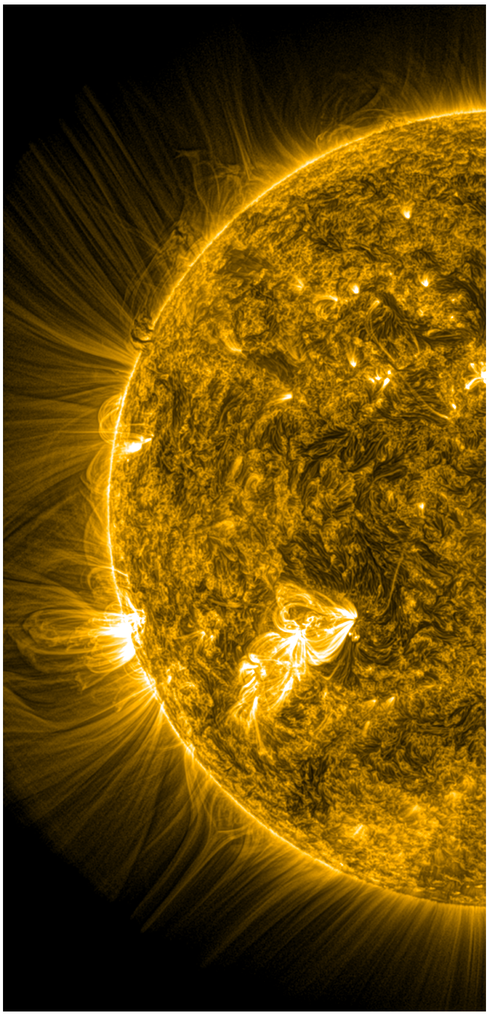

Figure 1. The Sun's corona as seen in Extreme Ultraviolet (from the Solar Dynamics Observatory). The bright plasma highlights the magnetic field and the highly inhomogeneous nature of the plasma is evident.